

What is claimed:

1. An anti-submarining seat-belt assembly for increasing survival chance of a passenger of a transport system in an accident or during in-flight turbulence, comprising

5 a seat belt, consisting of at least one shoulder belt portion (1.1, 1.2), a lap belt portion (1.3) and an extending belt portion (1.4);

a main buckle assembly (9.1), having a master release button (84) and attached to a stiff first transport-system member, generally representing a floor of the transport system adjacent to a first seat-side or a seat-cushion frame at the first seat-side or a mid-tunnel of
10 a motor vehicle adjacent to the first seat-side;

a lower belt deflector (17), deflecting and loosely guiding the lap belt portion (1.3) or the shoulder belt portion and attached to a stiff second transport-system member, generally representing the floor of the transport system adjacent to a second seat-side or the seat-cushion frame at the second seat-side or a post section of the motor vehicle adjacent to
15 the second seat-side or a side rail of the motor vehicle adjacent to the second seat-side; at least two latch plates (9, 11, 25), the first of which is a main latch plate (9), moveable along the lap- or shoulder belt portion, and the second of which is an anti-submarining latch plate (11, 25), moveable along the lap belt portion; and

anti-submarining buckle assemblies, attached to a seat frame of a seat, generally
20 representing the seat-cushion frame or a seat-backrest frame;

whereby

a lower part of the body (96) of the passenger and an upper part of the body (95) are restrained by the lap- and shoulder belt portions when the main latch plate (9) is plug-in connected to the main buckle assembly (9.1); and

25 the lap belt portion (1.3) is subdivided into two anti-submarining belt portions (1.3R, 1.3L) to restrain thighs of the passenger when the anti-submarining latch plate is plug-in connected to one of the anti-submarining buckle assemblies.

2. The anti-submarining seat-belt assembly according to claim 1, wherein the anti-submarining buckle assemblies (7, 8, 8a) have housings, located in the seat cushion (3.1, 3.1a
30 to 3.1d), and a common release button (84o), located on the seat, where the common release button, when depressed, releases the anti-submarining latch plate.

3. The anti-submarining seat-belt assembly according to claim 1, wherein the anti-submarining buckle assembly (8d) has a housing, located on the seat cushion (3.1, 3.1a to 3.1d) and provided with a release button (84d), which, when depressed, releases the anti-submarining latch plate.

5 4. The anti-submarining seat-belt assembly according to claim 2, wherein the master release button (84) is provided with release cables (4.2) connecting to release buttons of the anti-submarining buckle assemblies where the master release button, when depressed, releases the main latch plate and the anti-submarining latch plate from the respective buckle assemblies.

10 5. The anti-submarining seat-belt assembly according to claim 3, wherein the master release button (84) is provided with release cables (4.2) connecting to release buttons of the anti-submarining buckle assemblies where the master release button, when depressed, releases the main latch plate and the anti-submarining latch plate from the respective buckle assemblies.

15 6. The anti-submarining seat-belt assembly according to claim 2, wherein the master release button (84) is provided with release wires connecting to electrical release-motors (4.2b) of release buttons of the anti-submarining buckle assemblies where the master release button, when depressed, releases the main latch plate and the anti-submarining latch plate from the respective buckle assemblies.

20 7. The anti-submarining seat-belt assembly according to claim 3, wherein the master release button (84) is provided with release wires connecting to electrical release-motors (4.2b) of release buttons of the anti-submarining buckle assemblies where the master release button, when depressed, releases the main latch plate and the anti-submarining latch plate from the respective buckle assemblies.

25 8. The anti-submarining seat-belt assembly according to claim 1, wherein the supplement anti-submarining latch plate is a belt-detachable latch plate (25), having a quick-release pin (25.1) and a U-shaped portion to house the lap belt portion which is secured therein by the quick-release pin and detached therefrom by pulling it.

9. The anti-submarining seat-belt assembly according to claim 8, wherein the anti-submarining belt portions are provided with at least one pair of belt-detachable latch plates (25), which are plug-in connected to the anti-submarining buckle assemblies in the seat

cushion at the first and second seat-side to properly restrain the thighs with small circumference.

10. The anti-submarining seat-belt assembly according to claim 9, wherein the anti-submarining buckle assemblies (7, 8, 8a) have housings, located in the seat cushion (3.1, 3.1a to 3.1d), and a common release button (84o), located on the seat, where the common release button, when depressed, releases all the anti-submarining latch plates.

11. The anti-submarining seat-belt assembly according to claim 9, wherein the master release button (84) is provided with release cables (4.2) connecting to release buttons of the anti-submarining buckle assemblies where the master release button, when depressed, releases the main latch plate and all the anti-submarining latch plates from the respective buckle assemblies.

12. The anti-submarining seat-belt assembly according to claim 10, wherein the belt-detachable anti-submarining latch plates (25), when not being used, are stored and secured in a storage box (25.5) of the seat.

13. The anti-submarining seat-belt assembly according to claim 11, wherein the belt-detachable anti-submarining latch plates (25), when not being used, are stored and secured in a storage box (25.5) of the seat.

14. The anti-submarining seat-belt assembly according to claim 1, wherein a free-moving anti-submarining buckle assembly (8b, 8c) has a housing, free-moving on the seat cushion and provided with a release button (84e, 84f), and a length-adjustable belt (8.1), a free end of which is attached to the seat frame.

15. The anti-submarining seat-belt assembly according to claim 14, wherein the free-moving anti-submarining buckle assembly is provided with an electrical release-motor (4.2b), which, when receiving an electrical signal emitted from the main buckle assembly resulting from depressing the main release button releasing the main latch plate, pulls the release button to release the anti-submarining latch plate.

16. The anti-submarining seat-belt assembly according to claim 14, wherein the length-adjustable belt (8.1) is provided with vibration-dampening energy absorbers.

17. The anti-submarining seat-belt assembly according to claim 14, wherein the length-adjustable belt (8.1), having a property of limited energy absorption (70, 80), is provided with sites of predetermined fracture having threshold values.

18. The anti-submarining seat-belt assembly according to claim 17, wherein the sites of
5 predetermined fracture have different threshold values.

19. The anti-submarining seat-belt assembly according to claim 18, wherein the different threshold values are determined by different number of overlapped belt portions.

20. The anti-submarining seat-belt assembly according to claim 18, wherein the different threshold values are determined by seam stitches having different width.

10 21. The anti-submarining seat-belt assembly according to claim 18, wherein the different threshold values are determined by yarns having different yield strength.

22. The anti-submarining seat-belt assembly according to claim 18, wherein the different threshold values are determined by seams made from yarn sewn in different number of rows.

15 23. The anti-submarining seat-belt assembly according to claim 1, wherein a Vehicle Identification Number (81), arranged on a surface of an engraved belt portion of the seat belt, is concealed from unauthorized persons, intending to manipulate, when this surface is covered by a covering belt portion and both belt portions are sewn together.

20 24. The anti-submarining seat-belt assembly according to claim 23, wherein a manufacturing date, added to the Vehicle Identification Number (81), is arranged on the surface of the engraved belt portion of the seat belt.

25. The anti-submarining seat-belt assembly according to claim 1, wherein the anti-submarining buckle assembly is provided with a coupling fitting (1.2a, 1.2b) to receive vibration-dampening energy absorbers.

26. An anti-submarining seat-belt assembly for increasing survival chance of a passenger of
25 a transport system in an accident or during in-flight turbulence, comprising a two-point seat belt, which is a lap belt portion, a first end portion of which is fastened to a lower belt deflector (17) and a second end portion is loosely attached to a main latch plate (9);

a main buckle assembly (9.1), having a master release button (84) and attached to a stiff first transport-system member, generally representing a floor of the transport system adjacent to a first seat-side or a seat-cushion frame at the first seat-side or a mid-tunnel of a motor vehicle adjacent to the first seat-side;

5 the lower belt deflector (17), attached to a stiff second transport-system member, generally representing the floor of the transport system adjacent to a second seat-side or the seat-cushion frame at the second seat-side or a post section of the motor vehicle adjacent to the second seat-side or a side rail of the motor vehicle adjacent to the second seat-side;

at least two latch plates (9, 11, 25), the first of which is the main latch plate (9) and the
10 second is an anti-submarining latch plate (11, 25), moveable along the lap belt portion;
and

anti-submarining buckle assemblies, attached to a seat frame of a seat, generally representing the seat-cushion frame or a seat-backrest frame;

whereby

15 a lower part of the body (96) of the passenger is restrained by the lap belt portion when the main latch plate (9) is plug-in connected to the main buckle assembly (9.1); and
the lap belt portion is subdivided into two anti-submarining belt portions (1.3R, 1.3L) to restrain thighs of the passenger when the anti-submarining latch plate is plug-in connected to one of the anti-submarining buckle assemblies.

20